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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/687,197	10/14/2000	Yutaka Maruo	15.20/5332	9258

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EXAMINER

DUONG, KHANH B

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 09/11/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/687,197

Applicant(s)

MARUO, YUTAKA

Examiner

Khanh Duong

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 August 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) 11-25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 and 26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 October 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

This Office Action is in response to the Election, Paper No. 7, filed on August 23, 2002.

Election/Restrictions

Applicant's election of Group I, claims 1-10 and 26 in Paper No. 7 is acknowledged.

Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Accordingly, claims 11-25 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Currently, claims 1-10 and 26 are active in this application.

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: --METHOD FOR MANUFACTURING A SEMICONDUCTOR DEVICE HAVING A TRENCH ELEMENT ISOLATION REGION--

Drawings

Figures 34-38 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected

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drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: --METHOD OF MANUFACTURING A SEMICONDUCTOR DEVICE COMPRISING TRENCH ELEMENT ISOLATION REGIONS--

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3 and 6-10 are rejected under 35 U.S.C. 102(e) as being anticipated by Manning (US 5,275,965).

Re claim 1, Manning discloses a method of manufacturing a semiconductor device (see Figs. 1-9 and accompanying text) comprising the steps of: forming a polishing stopper layer 12 over a substrate 10, the polishing stopper layer 12 having a predetermined pattern for a chemical-mechanical polishing; removing a part of the substrate 10 using a mask layer 13 including at least the polishing stopper layer 12 as a mask to form a trench ; forming a trench oxide film 21 over a surface of the substrate 10 that forms the trench; forming an insulating layer 51 that fills the trench over an entire surface of the substrate 10; polishing the insulating layer 51 by a chemical-mechanical polishing; removing the polishing stopper layer 12; and etching a part of

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the insulating layer 51 to form a trench insulating layer, wherein the method further includes the step of forming an etching stopper layer 41 (polycrystal silicon, 50 nm) for the trench oxide film 21 over at least a portion of the trench oxide film 21, and wherein the etching stopper layer 41 is more resistant to the etching than insulating layer 51.

Re claim 3, Manning expressly shows in Fig. 4 that the etching stopper layer 41 is formed to cover a side surface of the trench oxide film 21.

Re claims 6-8, Manning discloses the etching stopper layer 41 is selected from polycrystal silicon and has a thickness of 500 angstroms (50 nm) (see col. 3, lines 4-15).

Re claims 9 and 10, Manning discloses the steps of thermally oxidizing a portion of the polycrystal silicon layer 41 that protrudes from the surface of the substrate in an element forming region to form a silicon oxide film; and removing the silicon oxide film at the same time as etching a part of the insulating layer 51 to form a trench insulating layer (see Figs. 8-9; col. 3, lines 32-51).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

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2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Manning.

Re claim 2, Manning fails to specifically show a selective etching ratio of the insulating layer 51 with respect to the polycrystal silicon etching stopper layer 41 being 10 or greater.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Manning by selecting an etching ratio of the insulating layer with respect to the polycrystal silicon etching stopper layer within the ranges as required by the claim, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claims 4, 5 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Manning in view of Hwang et al. (US 6,329,266).

Re claims 4 and 5, Manning discloses using polycrystal silicon, instead of silicon nitride, as the etching stopper layer.

Hwang et al. teaches that using silicon nitride as the etching stopper layer 205 which has a thickness of 30-60 nm (see Fig. 3; col. 3, lines 23-26). Since the use of polycrystal silicon and silicon nitride as etching stopper layers are considered equivalent techniques well known in the semiconductor art as evidenced by Manning and Hwang et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute one technique for the other.

Re claim 26, Manning fails to show forming the trench oxide layer on the lower surfaces of the trench.

Hwang et al. expressly shows in Fig. 2 forming the trench oxide layer 204 on the lower surfaces of the trench 203. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Manning with the teaching of Hwang et al., since Hwang et al. states at col. 3, lines 13-17 that such modification would reduce defects in silicon lattices caused by etching of the semiconductor substrate.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Rogers et al. (US '819), Jang et al. (US '090), Jang et al. (US '740) and Benedict et al. (US '487) disclose relevant methods for forming trench isolation elements.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Duong whose telephone number is (703)305-1784. The examiner can normally be reached on Monday - Friday (9:00 AM - 6:00 PM).


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (703)308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703)305-3431 for regular communications and (703)308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.



KBD

September 9, 2002



CARL WHITEHEAD, JR.
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